BDAT TREATMENT STANDARDS FOR D001 IGNITABLE COMPRESSED GASES 261.21(a)(3)
Deactivation (DEACT) to remove the characteristic of ignitability*

BDAT TREATMENT STANDARDS FOR D001 IGNITABLE REACTIVES 261.21(a)(2)
[Nonwastewaters]
Deactivation (DEACT) to remove the characteristic of ignitability*

BDAT TREATMENT STANDARDS FOR D001 OXIDIZERS 261.21(a)(4)
[Wastewaters and Nonwastewaters]
Deactivation (DEACT) to remove the characteristic of ignitability*

* See § 268.42 Table 1 in today's rule for a detailed description of all technologies referred to by a five letter technology code. See also part 268 appendix VI for a list of applicable technologies that used alone or in combination can achieve deactivation of ignitability.

c. Corrosive Characteristic Wastes

Paraphrasing the criteria for defining a D002 Corrosive waste (40 CFR 261.22), a waste can be a D002 waste if it is aqueous and has a pH less than or equal to 2; or it is aqueous and has a pH greater than or equal to 12.5; or it is a liquid and corrodes steel at a specified rate and temperature. EPA tentatively determined at proposal that these criteria translated into three subcategories, the Acid Subcategory, the Alkaline Subcategory, and the Other Corrosives Subcategory (54 FR 48422). In general, commenters supported this subcategorization of D002 wastes. Therefore, EPA is adopting this classification scheme in the final rule.

(1) *D002 Acid and Alkaline Subcategories.* The Acid Subcategory and the Alkaline Subcategory, refer to those D002 wastes that exhibit the properties listed in 40 CFR 261.22(a)(1) and are distinguishable by the appropriate pH specifications. The Acid Subcategory is defined as those wastes with a pH of less than or equal to 2.0, and the Alkaline Subcategory is defined as those wastes with a pH of greater than or equal to 12.5. Also by definition in § 261.22, D002 wastes in these two subcategories only include wastes which are considered to be "aqueous", due to the fact that standard pH measurements can only be performed in the presence of significant amounts of water (i.e., pH is the measure of the concentration of hydronium ions in water).

D002 wastes in the Acid Subcategory typically include concentrated spent acids, acidic wastewaters, and spent acid strippers and cleaners. Wastes in the Alkaline Subcategory typically include concentrated spent bases, alkaline wastewaters, and spent alkaline strippers and cleaners. These wastes represent a significant portion of all hazardous wastes generated by almost every industry.

EPA proposed a treatment standard of "Base Neutralization to a pH 6 to 9 and Insoluable Salts" for the D002 Acidic Subcategory (54 FR 48422). Likewise, EPA proposed a treatment standard of Acid Neutralization to a pH 6 to 9 and Insoluble Salts" for the D002 Alkaline Subcategory (54 FR 48422).

(i.) Comments Concerning the Proposed pH Requirements. Treatment of acids and bases is generally referred to as "neutralization". In the proposed rule, the Agency interpreted this to mean a pH range of 6 to 9. This range was selected based on a rounding off of the pH range found in fresh water aquatic ecosystems through natural carbonate/bicarbonate buffering (i.e., pH 5.5 to 8.5). While a "true" neutral pH is equal to 7, by proposing the pH 6 to 9 range, the Agency was recognizing that even in natural systems, pH can fluctuate significantly. Thus, the Agency's underlying premise was that treatment of corrosive wastes should result in a pH range (i.e., pH 6 to 9) that was referred to as "neutral".

In addition, the Agency expressed concern on whether a waste with a pH 2 to 6 could have a negative impact on the effectiveness of a clay liner in mitigating the mobility of hazardous constituents from surface impoundments. In fact, this was one of the major concerns of Congress with respect to the statutory land disposal restrictions imposed by HSWA on all hazardous wastes with pH less than 2. (See generally 52 FR 25760 through 25792 (July 8, 1987) where EPA codified these restrictions for all corrosive wastes (without specifically referring solely to D002 wastes.)).

EPA received many comments pertaining to the impact that the pH range of 6 to 9 would have on generators and treaters of D002 wastes. Commenters documented that enormous disruptions of existing wastewater treatment systems would occur if the standard were promulgated with the proposed pH restrictions. For example, every surface impoundment or injection well receiving commingled wastes (some of which were D002 corrosive wastes at the point of generation, but once commingled were above pH 2 (or below pH 12.5) and therefore no longer considered hazardous by section 261.22) that were outside of the pH 6 to 9 range would be in violation of the standard. This would effect thousands of such units (most of which are RCRA subtitle D units and hence not presently affected by RCRA subtitle C).

With regard to the proposed pH 6 to 9 requirement for underground injection units, several commenters stated that the proposed pH range would cause problems in many of the injection units and wells, because some metals tend to precipitate out of solution at these pH ranges resulting in plugging in either the injection unit itself or further inside the well. Commenters also stated that specific pH ranges are typically required in permits for many underground injection wells and are typically at levels less than pH 6 to ensure that the injected fluid flows properly through the injection zone without plugging.

Another commenter remarked that they treat an acidic D002 waste only to a pH of 4.5 prior to commingling with other wastes that require biodegradation. This is done in order to counter the production of alkaline ammonia during the biodegradation process, and thereby aids in maintaining a "neutral" pH in the biodegradation process.

Other commenters pointed out that a pH of 10 is often considered the optimum pH for removal of most metals from wastewaters and that requiring a pH of 6 to 9 would cause severe disruptions in most metals removal treatment systems. These treatment systems generally consist of chemical precipitation in tanks to remove metals followed by neutralization of the effluent in surface impoundments prior to discharge.

As a result of all of the comments on pH ranges mentioned above and for the reasons mentioned below, the Agency is not promulgating the proposed pH range of 6 to 9. While the Agency maintains that in some cases a pH of 6 to 9 may be considered desirable, the Agency believes the Clean Water Act, end-of-pipe, NPDES limitations will address these specific situations, where water quality issues are of concern (specifically where discharges of such neutralized wastewaters are into fresh water ecosystems). (Note: The Agency points out that pH is commonly already regulated for such discharges.)

The Agency also notes that liquids are not allowed in subtitle C landfills under section 3004(c). As mentioned by the

commenters (and discussed above), requiring a pH range of 6 to 9 before discharge to most surface impoundments will cause severe disruptions in existing treatment operations. Additionally, the Agency believes that its concern regarding the impact of corrosive wastes on the integrity of clay liners is addressed mostly by the statutory restrictions on a pH of less than 2. The Agency currently has little data on the impact that wastes containing pH of 2 to 6 may have on clay liners. Finally, regarding the proposed pH range, the Agency did not intend to interfere with optimum pH levels desired for treatment of metals in tanks, nor did it intend for these standards to interfere with other legitimate wastewater treatment operations (such as the biotreatment processes mentioned by the commenter).

(ii.) Comments Concerning the Proposed Acid and Base Requirements. EPA additionally proposed that "neutralization" of wastes in the D002 Acidic and Alkaline subcategories be accomplished specifically through the use of the corresponding neutralization chemicals (i.e., acids to neutralize the Alkaline Subcategory and bases to neutralize the Acidic Subcategory). As commenters quickly pointed out, almost all chemicals (including water which dissociates into hydronium and hydroxide ions) have some acid character and some basic character depending upon the reference chemical. That is what is historically been taught in academia as the "Lewis Acid Theory". The Agency never intended to dispute basic chemical theory, but was merely stating its preference to neutralize the corrosive characteristic of these wastes with chemicals that would result in an overall reduction in total dissolved solids in effluent (i.e., the use of these chemicals is coupled with the concept of the proposed requirement to create insoluble salts rather than the concept of neutralization to a specific pH). (See also the discussion on insoluble salts in the preamble discussion following this one.)

With respect to the use of these chemicals (i.e., acids and bases) to achieve the treatment standard, several commenters stated that it is not always necessary to use chemicals that are specifically identified as commercial acids or bases to achieve treatment of D002 wastes. In fact many facilities generate both acidic and alkaline wastes (often from different processes) and commonly use them to neutralize each other. This situation also occurs at commercial hazardous waste treatment facilities, ir that the facilities will take acid wastes from various generators and will neutralize them with alkaline wastes from other generators. In general, commercial acids and bases are used to complete the neutralization processes and often are used only for pH adjustment of the final wastewater discharges. Many commenters also pointed out that the mixing of D002 corrosive wastes with other wastewaters (even other acidic, noncorrosive wastes) will contribute to an overall neutralization due to the resultant change in pH. This is because pH is merely a measure of the concentration of hydronium ions (H^+) in water and is dependent upon the equilibrium constant for the dissociation of water into hydronium and hydroxide ions. As more water is present, the equilibrium will be shifted and thereby increase the pH; resulting in "neutralization." Because of this, EPA is specifically allowing mixing of D002 wastes with each other and with other wastewaters to remove the characteristic of corrosivity (i.e., resulting in a pH between 2 and 12.5). However, EPA's allowance of mixing wastes to remove corrosivity does not override other prohibitions on dilution of wastes for other purposes (i.e., this does not override other dilution prohibitions that may be applicable for other wastes).

Many commenters declared that incineration should also be allowed as treatment for D002 wastes, especially for organic acids, mixed D001/D002 waste streams, and other D002 wastes with organics. Pollution control devices on incinerators will remove corrosive gases from the burning of these D002 wastes. Alkaline scrubber waters are often employed in these air pollution control devices in order to neutralize acidic emissions. These scrubber waters are then further neutralized if necessary. The Agency agrees with the commenters that incineration is an applicable treatment method for some D002 wastes and is thus not precluding incineration as treatment of D002 wastes.

(iii.) Comments Concerning the Insoluble Salt Requirement. The Agency proposed that neutralization of wastes in the D002 Acid and Alkaline Subcategories should be required to result in insoluble salts. The reason was that the Agency felt that the overall dissolved solids loading on fresh water aquatic systems could be reduced by establishing such a standard, even though it would result in an insoluble sludge that would require landfilling. The Agency believed that such a standard would discourage the generation of D002 acids and alkaline wastes and thereby promote minimization/source reduction as well as recycling of acids (either directly or after some form of pretreatment). While the Agency maintains that the goal behind the proposed standard is consistent with national policy on waste minimization and the Agency's overall concerns on cross-media impacts of both hazardous and nonhazardous constituents on the entire environment, many commenters presented technical complications with the proposed requirement on insoluble salts that the Agency has found persuasive.

The Agency received numerous comments concerning this proposed requirement indicating that neutralization and formation of insoluble salts is either impractical or technically impossible for some of the most commonly used acids and bases that become D002 wastes (such as nitric acid, hydrochloric acid, sodium hydroxide, potassium hydroxide, other acid halides). Because the salts generated from the neutralization of these particular acids and bases are very soluble in water, the proposed requirement to generate insoluble salts would result in treatment with exotic chemicals in order to comply (if there are any methods at all to create insoluble salts). The Agency concurs with the commenters. This is further supported by the fact that almost all nitrate and chloride salts of the major metals are very soluble in water.

Other commenters stated that requiring the formation of insoluble salts often will negate the use of alkaline and acidic process wastes that are generated on-site for neutralization. This would in effect, result in double the volume of insoluble salts that would have to be disposed and use up valuable virgin commercial acids and bases that otherwise would not be needed. As stated in the preceding sections of this discussion on corrosive wastes, the Agency never intended to preclude such on-site neutralization with wastes, and agrees that this would probably result in an unnecessary use of virgin materials for waste treatment.

Additionally, one commenter points out that in many cases neutralization of D002 wastes that contain organics, is often a necessary pretreatment step for other treatment processes (such as steam stripping, biological treatment and/or carbon adsorption) that remove or destroy the organics in the waste. If a sludge must be formed during the neutralization process, organic constituents that could have been destroyed or removed while in the wastewaters are instead being

transferred to the solid phase where they will be either disposed of untreated or where they may require treatment with incineration. The Agency shares the commenters concerns on treatment of organics in D002 wastes.

As a result, the Agency is withdrawing the requirement for neutralization to insoluble salts for wastes in the D002 Acid and Alkaline subcategories. In doing so, the Agency's concerns of using acids and bases to provide neutralization is a moot point.

(iv.) Promulgated Treatment Standards. For the reasons outlined in the previous discussions, the Agency is withdrawing the proposed treatment standards for D002 Acid and Alkaline Subcategories. The Agency considered promulgating a treatment standard as a specified technology, namely "Neutralization". However, the Agency found that in certain cases, "incineration" and "recovery" processes were also quite applicable to wastes in these subcategories.

In addition, many D002 wastes also are hazardous for other reasons, and may require that additional treatment processes be employed besides neutralization, incineration, or recovery. For example, a facility may have interpreted that biodegradation would have been precluded from use, for a D002 waste that also contained organics. Since biodegradation may have actually been a technically viable alternative for this waste, the facility would have had to submit a petition for a treatability variance. While the Agency probably would have granted it, the variance process would have created an unnecessary burden on both the regulatory and regulated community, and probably without incurring any additional protection of human health and the environment.

As a result, EPA is promulgating a general treatment standard for wastes in the D002 Acid and Alkaline Subcategories that allows the use of any appropriate treatment technology, namely: "Deactivation (DEACT) to Remove the Characteristic of Corrosivity". This means that the facility may use any treatment (including neutralization achieved through mixing with other wastewaters) that results in a pH above 2 but less than 12.5, and thereby removes the characteristic of corrosivity. See section 268 Appendix VI of today's rule for a list of applicable technologies that used alone or in combination can achieve this standard. (See also § 268.42 Table 1 for a technical description of these technologies. A five letter code (acronym) for each technology has been established in order to simplify the tables.)

EPA has adopted this standard, in part, to avoid the massive disruptions to wastewater treatment systems that would have resulted from the proposed standard (which impacts far exceeded any others that would have resulted under the proposed rule), and because the final standard does require the removal of the property of corrosivity. Corrosivity is not defined in the same way EP Toxic wastes are defined. Corrosivity is not based on a toxic constituent, where the environmental concern is mass-loading in the environment. With respect to the issue of toxics present in these corrosive wastes, EPA notes that if a corrosive waste also exhibits the toxicity characteristic, it must be treated to meet the treatment standard for the toxic constituent as well (see generally section III.A.1. of this preamble).

The Agency received many comments regarding non-liquid wastes that are corrosive and the applicability of treatment technologies for aqueous and liquid corrosive wastes to treat non-liquid corrosive wastes. The proposal did not specifically address corrosive solids because there is not a definition of corrosive solids in § 261.22 at this time. Until the Agency amends § 261.22 to include a definition for corrosive solids and promulgates a treatment technology, generators must prudently handle wastes with regard to known hazards. Although not required under current regulations, many generators of corrosive solids prefer to classify these wastes as D002 corrosives and choose waste management and disposal protocols accordingly in an added effort to protect the environment.

(2) *Other D002 Corrosives.* The third major subcategory is classified as the Other Corrosives Subcategory and is defined as those D002 wastes that exhibit corrosivity to steel as defined in § 261.22(a)(2). They often are nonaqueous corrosive wastes such as certain organic liquids, but can represent inorganic chemicals as well.

Wastes in the Other D002 Corrosives Subcategory are generated on a sporadic basis and generally in low volumes. The Agency suspects that these wastes are often identified as corrosive without performing the specified testing with steel (i.e., the corrosivity of the waste may be assumed due to the presence of known corrosive constituents). This may also be due, in part, to the high cost of testing and to the difficulties in identifying laboratories that are experienced in steel corrosion testing.

The physical and chemical characteristics of this group of wastes vary greatly. The wastes may be aqueous or they may be primarily organic. In addition, a large variety of corrosive chemicals may appear as constituents in this type of corrosive waste. Depending on the concentration of these corrosive chemicals, they may corrode SAE 1020 steel. Examples of chemicals that may contribute to corrosivity include ferric chloride. benzene sulfonyl chloride, benzotrichloride, acetyl chloride, formic acid, hydrofluoric acid, some catalysts, various resins, metal cleaners, and etchants. Highly concentrated acids that have no water may also be included in this subcategory, since pH measurements are not possible on these wastes.

Wastes in the Other Corrosives Subcategory are often treated by deactivating the corrosive constituents of the waste with an appropriate chemical reagent. Wastes that contain high concentrations of corrosive organics are often incinerated; however, due to the great variety of potential corrosive organics, the Agency does not believe that it should establish concentration-based standards based on incineration for these D002 wastes. Removal and recovery of either organic or inorganic corrosive constituents may also be applicable technologies, since recovery could extract the corrosive constituents until the waste itself is no longer corrosive to steel.

EPA proposed a treatment standard of "Deactivation" for D002 wastes in the Other Corrosives Subcategory. The Agency took this approach for these wastes since the hazardous characteristic is based on imminent hazard (i.e., the corrosivity to steel may cause rupture of a tank or container, thus releasing the contents either suddenly or through leaks) rather than on other criteria such as levels of hazardous constituents, and that technologies exist that can completely remove this characteristic.

EPA continues to believe that the proposed standard is appropriate for wastes in the D002 Other Corrosives Subcategory and is promulgating a treatment standard of "Deactivation (DEACT) to Remove the Characteristic of Corrosivity". See section 268 Appendix VI of today's rule for a list of applicable technologies that used along or in combination can achieve this standard. (See also § 268.42 Table 1 for a technical description of these technologies. A five letter code (acronym) for each technology has been established in order to simplify the tables.) This standard will allow the use of the "best" treatment based on the

chemical and physical characteristics of the waste.

BDAT TREATMENT STANDARDS FOR D002 ACID SUBCATEGORY 261.22(a)(1)
Deactivation (DEACT) to remove the characteristic of corrosivity*

BDAT TREATMENT STANDARDS FOR D002 ALKALINE SUBCATEGORY 261.22(a)(1)
Deactivation (DEACT) to remove the characteristic of corrosivity*

BDAT TREATMENT STANDARDS FOR D002 OTHER CORROSIVES 261.22(a)(2)
Deactivation (DEACT) to remove the characteristic of corrosivity*

*See section 268 appendix VI of today's rule for a list of applicable technologies that used alone or in combination can achieve this standard. See also § 268.42 Table 1 for a description of the technologies indicated by a five letter code.

d. Reactive Characteristic Wastes

According to 40 CFR 261.23, there are eight criteria for defining a waste as a D003 Reactive waste. Paraphrasing these criteria, a waste can be a D003 waste if: (1) It is unstable and readily undergoes violent changes without detonating; or (2) it reacts violently with water; or (3) it forms potentially explosive mixtures with water; or (4) when mixed with water, it generates toxic gases; or (5) it is a cyanide or sulfide bearing waste which under certain conditions can generate toxic gases; or (6) it is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement; or (7) it is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure; or (8) it is a forbidden explosive, a Class A explosive, or a Class B explosive.

EPA tentatively determined at proposal that these eight criteria translated into five subcategories for D003 wastes (54 FR 48424). Commenters concurred with these classifications. The first subcategory is classified as the Reactive Cyanides subcategory and refers to those D003 wastes that exhibit the properties listed in § 261.23(a)(5) for cyanide. The second subcategory is classified as the Explosives subcategory and refers to those D003 wastes that exhibit the properties listed in §§ 261.23(a)(6) through 261.23(a)(8). The third subcategory is classified as the Water Reactive subcategory and refers to those D003 wastes that exhibit the properties listed in §§ 261.23(a)(2) through 261.23(a)(4). The fourth subcategory is classified as the Reactive Sulfides subcategory and refers to those D003 wastes that exhibit the properties listed in § 261.23(a)(5) for sulfide. The fifth subcategory is classified as the Other Reactives subcategory and refers to those D003 wastes that exhibit the properties listed in § 261.23(a)(1).

For all subcategories of D003 wastes except the Reactive Cyanides, the Agency believes that development of concentration-based treatment standards would be difficult because there are no known analytical tests that are specifically designed to measure the particular reactivity associated with each D003 treatability subcategory, nor is there a test that distinguishes the reactive chemical from the deactivated chemical.

The Agency solicited comments and data on the physical and chemical characterization of all five subcategories of D003 wastes. The Agency also requested comment on the applicability of chemical deactivation, incineration, and any other type of chemical or physical deactivation technology to these wastes.

(1) *Reactive Cyanides.* D003 wastes in the Reactive Cyanides Subcategory are by definition those cyanide-bearing wastes that generate toxic gases (assumed to be hydrogen cyanide) when exposed to pH conditions between 2 and 12.5, in a sufficient quantity to present a danger to human health and the environment (40 CFR 261.23(a)(5)). Commenters requested clarification of which analytical methods should be used to determine reactive cyanide and associated toxic gas liberation. EPA's approved analytical procedures can be found in SW–846 Vol. 1C, Chapter 7 which defines the characteristic and regulation of reactive wastes. Specifically, Section 7.3.3.2 describes the "Test Method to Determine Hydrogen Cyanide Released from Wastes" which outlines the correct procedure of hydrogen cyanide gas liberation from reactive wastes. Method 9010 is the analytical method for quantitatively determining reactive cyanide concentrations.

The reactive cyanide wastes typically are generated by the electroplating and metal finishing industries, and include mixed cyanide salts, cyanide solutions, and cyanide-bearing sludges. Most of the volume of all D003 wastes that are generated can be identified as wastes belonging to the Reactive Cyanides Subcategory. Reactive cyanide wastes are not typically placed directly in most types of land disposal units without treatment; however, it is possible that some untreated wastes are placed in surface impoundments.

Reactive cyanide wastes (like other reactive wastes) are already subject to special requirements prior to disposal in landfills, surface impoundments, and waste piles under existing regulations. Also, as a July 8, 1987 (the statutory deadline for the California list prohibitions), liquid hazardous wastes having a free cyanide concentration in excess of 1,000 mg/kg (ppm) were prohibited from land disposal. No one has suggested, however, that these existing regulations and prohibitions are sufficient to apply to the Reactive Cyanides Subcategory. The statute did not specifically identify the California list cyanides as D003 wastes, and furthermore, it did not specify a required method of treatment, nor did it establish the 1,000 mg/kg prohibition level as a "treatment standard".

The Agency believes that simple cyanides (e.g. NaCN, KCN) are more likely to react to liberate hydrogen cyanide gas since they are soluble and have weaker bond energies than complex cyanides (e.g., $Fe_3[Fe(CN)_6]_2$, $Ni[Fe(CN)]_2$, $Zn_2Fe(CN)_6$). Consequently, EPA believes that simple cyanide rather than complex cyanide is the cyanide form most likely to give a waste containing cyanide the characteristic of reactivity. Accordingly, the Agency believed at the time of proposal that most D003 nonwastewaters resembled wastes containing simple cyanides (i.e., F011, F012 and P030) rather than wastes containing complex cyanides (i.e., F006, F007, F008, F009). Treatment technologies applicable for treatment of D003 reactive cyanide wastes include electrolytic oxidation, alkaline chlorination and wet air oxidation.

The Agency proposed to transfer the treatment performance of simple cyanide nonwastewaters (i.e., mixture of F011 and F012) using electrolytic oxidation followed by alkaline chlorination developed in the Second Third final rule (54 FR 26594, June 23, 1989), the nonwastewaters in the Reactive Cyanides Subcategory (54 FR 48425). In other words, the Agency believed all D003 reactive cyanide nonwastewaters could be treated to a total cyanide level of 110 mg/kg and an amenable cyanide level of 9.1 mg/kg representing treatment of wastes containing simple cyanides (i.e., F011 and F012) instead of a total cyanide level of 590 mg/kg and an amenable